

WHAT IS CLAIMED IS:

- cont C1 Sub 1. An image pickup device provided with a color filter array composed of color filters arranged in the horizontal and vertical directions and an image pickup element for picking up the image of an object through said color filter array:
- 5
- wherein said color filter array comprises color filter groups of plural units in which each unit comprises first to eighth color filter groups and each
- 10 color filter group representing a column comprises an array of said color filters;
- the first color filter group comprising an alternate array of first and second color filters;
- the second color filter group comprising an
- 15 alternate array of third and fourth color filters;
- the third color filter group comprising an alternate array of the second and first color filters;
- the fourth color filter group comprising an alternate array of the fourth and third color filters;
- 20 the fifth color filter group being composed in the same manner as the third color filter group;
- the sixth color filter group being composed in the same manner as the second color filter group;
- the seventh color filter group being composed in
- 25 the same manner as the first color filter group; and
- the eighth color filter group being composed in the same manner as the fourth color filter group.

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2. An image pickup device according to claim 1, wherein said first to fourth color filters are of yellow, cyan, magenta and green.

5 3. An image pickup device comprising an image pickup element for picking up an image of an object, said image pickup comprising:

a color filter array comprising the color filters arranged in the horizontal and vertical directions,  
10 through which the image of the object is picked up by said image pickup element;

plural pixels constituting photoelectric converting elements arranged in the horizontal and vertical directions, respectively corresponding to said color filters;

a plurality of vertical charge transfer units provided respectively corresponding to the columns of said pixels in the vertical direction, for transferring electric charges from said pixels in the vertical  
20 direction;

a horizontal charge transfer unit connected to the ends of said vertical charge transfer units, for transferring the electric charges, transferred from said vertical charge transfer units, in the horizontal  
25 direction; and

an output unit for converting the signal charges transferred from said horizontal charge transfer unit

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into an image signal and outputting said image signal,  
wherein said color filter array comprises an  
array, in the vertical direction, of a plural units of  
color filter groups wherein each unit comprises 8 rows  
5 in which an odd-numbered row is composed of an  
alternate array of a first color filter and a second  
color filter in a predetermined order while an even-  
numbered row is composed of an alternate array of a  
third color filter and a fourth color filter in a  
predetermined order; and

the image signal corresponding to one row, within  
the image signal obtained from said image pickup  
element in a single image pickup operation, is  
outputted as a line-sequential color difference signal  
15 of said pixels of 4 rows in the vertical direction.

4. An image pickup device according to claim 3,  
wherein:

said color filter at a  $(4n+1)$ th row and an odd-  
20 numbered column is same as the color filter at a  
 $(4n+3)$ th row and an even-numbered column;

said color filter at a  $(4n+2)$ th row and an odd-  
numbered column is same as the color filter at a  
 $(4n+4)$ th row and an even-numbered column;

said color filter at a  $(4n+1)$ th row and an even-  
25 numbered column is same as the color filter at a

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( $4n+3$ )th row and an odd-numbered column; and

said color filter at a ( $4n+2$ )th row and an even-numbered column is same as the color filter at a ( $4n+4$ )th row and an odd-numbered column;

5           n being an integer equal to or larger than 0.

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5. An image pickup device according to claim 3,  
wherein the signal charges of two predetermined pixels  
which are mutually adjacent in the vertical direction,  
10 among the pixels arranged respectively corresponding to  
said color filter, are added and an image signal  
corresponding to said added signal charges is outputted  
from said output unit.

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15 6. An image pickup device according to claim 4,  
wherein the signal charges of two predetermined pixels  
which are mutually adjacent in the vertical direction,  
among the pixels arranged respectively corresponding to  
said color filter, are added and an image signal  
20 corresponding to said added signal charges is outputted  
from said output unit.

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25 7. An image pickup device according to claim 5,  
wherein said added signal charges of the two pixels are  
further added with the signal charges of two  
predetermined pixels which are present in the diagonal  
direction to the first-mentioned two pixels in a column

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adjacent to that of the first-mentioned two pixels, and an image signal corresponding to the added signal charges of four pixels is outputted from said output unit.

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8. An image pickup device according to claim 6, wherein said added signal charges of the two pixels are further added with the signal charges of two predetermined pixels which are present in the diagonal direction to the first-mentioned two pixels in a column adjacent to that of the first-mentioned two pixels, and an image signal corresponding to the added signal charges of four pixels is outputted from said output unit.

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9. An image pickup device according to claim 7, wherein an image signal corresponding to signal charges is outputted from said output unit by combining a method of adding the signal charges in said vertical direction and in said diagonal direction and a method of further adding, to the signal charges added in said vertical direction, signal charges in said vertical direction.

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10. An image pickup device according to claim 8, wherein an image signal corresponding to said signal charges is outputted from said output unit by combining

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a method of adding the signal charges in said vertical direction and in said diagonal direction and a method of further adding, to the signal charges added in said vertical direction, signal charges in said vertical direction.

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11. An image pickup device according to claim 3, wherein said color filters corresponding to said predetermined two pixels are a combination of cyan and green and a combination of yellow and magenta, or a combination of yellow and green and a combination of cyan and magenta.

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12. An image pickup device according to claim 4, wherein said color filters corresponding to said predetermined two pixels are a combination of cyan and green and a combination of yellow and magenta, or a combination of yellow and green and a combination of cyan and magenta.

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13. An image pickup device according to claim 5, wherein said color filters corresponding to said predetermined two pixels are a combination of cyan and green and a combination of yellow and magenta, or a combination of yellow and green and a combination of cyan and magenta.

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14. An image pickup device according to claim 6,  
wherein said color filters corresponding to said  
predetermined two pixels are a combination of cyan and  
green and a combination of yellow and magenta, or a  
5 combination of yellow and green and a combination of  
cyan and magenta.

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15. An image pickup device according to claim 7,  
wherein said color filters corresponding to said  
predetermined two pixels are a combination of cyan and  
green and a combination of yellow and magenta, or a  
combination of yellow and green and a combination of  
cyan and magenta.

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16. An image pickup device according to claim 8,  
wherein said color filters corresponding to said  
predetermined two pixels are a combination of cyan and  
green and a combination of yellow and magenta, or a  
combination of yellow and green and a combination of  
20 cyan and magenta.

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17. An image pickup device according to claim 9,  
wherein said color filters corresponding to said  
predetermined two pixels are a combination of cyan and  
green and a combination of yellow and magenta, or a  
combination of yellow and green and a combination of  
cyan and magenta.

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Sub C8 18. An image pickup device according to claim 10, wherein said color filters corresponding to said predetermined two pixels are a combination of cyan and green and a combination of yellow and magenta, or a combination of yellow and green and a combination of cyan and magenta.

Sub B8 19. An image pickup device according to claim 3, wherein said image pickup element further comprises electrodes each of which is connected commonly to every fourth pixel in the vertical direction, and which are adapted to control the read-out of the signal charges from said pixels to said vertical charge transfer units and to control the transfer of the signal charges from said vertical charge transfer units to said horizontal charge transfer unit.

Sub C9 20. An image pickup device according to claim 4, wherein said image pickup element further comprises electrodes each of which is connected commonly to every fourth pixel in the vertical direction, and which are adapted to control the read-out of the signal charges from said pixels to said vertical charge transfer units and to control the transfer of the signal charges from said vertical charge transfer units to said horizontal charge transfer unit.

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21. An image pickup device according to claim 5,  
wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

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22. An image pickup device according to claim 6,  
wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

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23. An image pickup device according to claim 7,  
wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from

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cond (said vertical charge transfer units to said horizontal  
charge transfer unit.

24. An image pickup device according to claim 8,  
5 wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
10 from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

25. An image pickup device according to claim 9,  
15 wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
20 from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

26. An image pickup device according to claim 10,  
25 wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are

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adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

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27. An image pickup device according to claim 11,  
wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

28. An image pickup device according to claim 12,  
wherein said image pickup element further comprises  
electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

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29. An image pickup device according to claim 13,

wherein said image pickup element further comprises electrodes each of which is connected commonly to every fourth pixel in the vertical direction, and which are adapted to control the read-out of the signal charges from said pixels to said vertical charge transfer units and to control the transfer of the signal charges from said vertical charge transfer units to said horizontal charge transfer unit.

10 *sub B* 30. An image pickup device according to claim 14, wherein said image pickup element further comprises electrodes each of which is connected commonly to every fourth pixel in the vertical direction, and which are adapted to control the read-out of the signal charges from said pixels to said vertical charge transfer units and to control the transfer of the signal charges from said vertical charge transfer units to said horizontal charge transfer unit.

20 *sub B* 31. An image pickup device according to claim 15, wherein said image pickup element further comprises electrodes each of which is connected commonly to every fourth pixel in the vertical direction, and which are adapted to control the read-out of the signal charges from said pixels to said vertical charge transfer units and to control the transfer of the signal charges from said vertical charge transfer units to said horizontal

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*C14* 32. An image pickup device according to claim 16,  
wherein said image pickup element further comprises  
5 electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
10 said vertical charge transfer units to said horizontal  
charge transfer unit.

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*B14* 33. An image pickup device according to claim 17,  
wherein said image pickup element further comprises  
15 electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges  
from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
20 said vertical charge transfer units to said horizontal  
charge transfer unit.

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*C15* 34. An image pickup device according to claim 18,  
wherein said image pickup element further comprises  
25 electrodes each of which is connected commonly to every  
fourth pixel in the vertical direction, and which are  
adapted to control the read-out of the signal charges

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*cmd* from said pixels to said vertical charge transfer units  
and to control the transfer of the signal charges from  
said vertical charge transfer units to said horizontal  
charge transfer unit.

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